GUIDELINES FOR DYNAMIC ENVIRONMENTAL CRITERIA: AN INVITATION TO PARTICIPATE IN THEIR DEVELOPMENT

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The development of guidelines for dynamic design and test criteria has recently been initiated under the sponsorship of the Office of Safety and Mission Quality, NASA Headquarters. To ensure that all current methods of criteria derivation are included, an invitation is being extended to all practitioners to participate in the preparation of these guidelines.

Over 25 years have elapsed since the "watershed" period of research and development that supported the Apollo program. Nearly 25 years have elapsed since the state-of-the-art of space vehicle dynamic prediction, design, analysis and testing was summarized and assessed, mainly in four NASA documents [1-4]. In the intervening years, a great many improvements and a few breakthroughs have been made in the dynamics field, including

1) widespread utilization of digital data acquisition equipment,
2) avoidance of dynamic measurement problems through better information and instruments,
3) knowledge of pyroshock measurement limitations,
4) development of nonstationary random data analysis techniques,
5) better statistical data evaluation methods,
6) computerized databases,
7) improved finite element modeling and dynamic loads analyses,
8) FEM extension to higher frequencies,
9) more realistic methods of representing structural damping,
10) more detailed comparisons of loads analyses and flight data,
11) better estimates of coupling loss factors for statistical energy analyses,
12) SEA extension to transient analyses,
13) utilization of the boundary element method of acoustic analysis,
14) development of fill factors for acoustic cavity analysis,
15) improved multi-channel analyses,
16) improved modal test and data processing techniques,
17) better vibration and acoustic test facilities and control systems,
18) utilization of force limiting in vibration testing,
19) elimination of sine testing for simulating transient loading, and
20) improved methods of dynamic risk assessment,

Much of this advancement was made possible through improvements in electronics, especially in the form of inexpensive and more accessible desk and lap top computers, and better testing and instrumentation systems. Also, much better knowledge was gained on the limitations of various dynamic techniques. Therefore, it seemed appropriate to prepare a new state-of-the-art survey of space vehicle dynamics. The obvious goal of these new guidelines is to provide a single source of information and references for a new generation of dynamicists, and for managers, project engineers and non-dynamics personnel when new dynamics problems are encountered. A brief outline and schedule of activities for the preparation of this document are shown in Figure 1.

To initiate the voluntary participation in the development of these guidelines, each participant or organization is requested to respond to one or more of four questionnaires on the following topics:

1. Acoustic and Aerodynamic Noise
11. High Frequency Random Vibration
111. High Frequency Transients and Pyroshocks
IV. Low Frequency Loads and Environments

These questionnaires are designed to be respondent-friendly, i.e., the respondent(s) is asked to check-mark the right hand side if there is agreement with a question or statement, Sometimes, a brief explanation, clarification, or detail is requested. If you or your organization wish to participate in this endeavor, please fill out and return the enclosed distribution form.

REFERENCES

1. Barnoski, R. L., Piersol, A, G., Van der Laan, W. F., White, P. H., and Winter, E. F. Apr. 1969. "Summary of Random Vibration Prediction Procedures," NASA CR-1302 [MSFC-sponsored].
2. Himelblau, H., Fuller, C. M. and Scharton, T. D. July 1970. "Assessment of Space Vehicle Aeroacoustic Noise-Induced Vibration Prediction, Design, Analysis and Testing," NASA CR-1596 [LaRC-sponsored].
3. Kacena, W. J., McGrath, M. B. and Rader, W. P. Mar. 7, 1970. "Aerospace Systems Pyrotechnic Shock Data," Martin-Marietta Rep, MCR-69-611 [GSFC-sponsored].
4. Eldred, K. M. June 1971. "Acoustic Loads Generated by the Propulsion S ystern," NASA SP-8072 [LaRC-sponsored].

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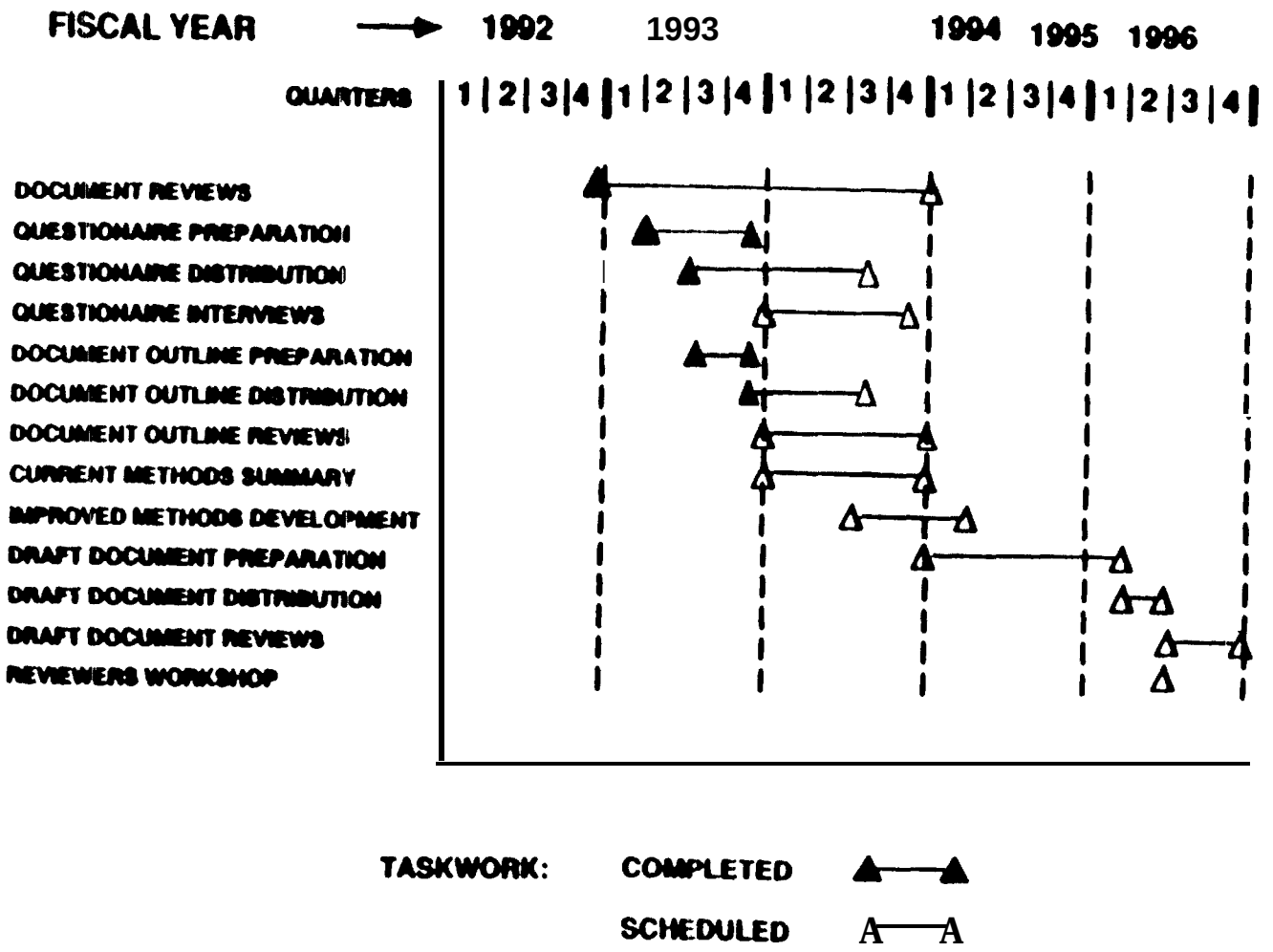

Figure 1. Outline and Schedule for Dynamic Environmental Criteria Guidelines

DYNAMIC CRITERIA QUESTIONNAIRE DISTRIBUTION FORM

Recommended by: _____

Name(s), Organization, Address, Phone & FAX Numbers (if known)	Questionnaire No.'			
	1	II	m	Iv

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IES: 5/1-6/94

01. Acoustic and Aerodynamic Noise
n. High Frequency Random Vibration
III. High Frequency Transients on Pyroshocks
Iv. Low Frequency Loads and Environments